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ABSTRACT

This life science guide is one of a series of guides, K-12, that were developed by teachers to help introduce environmental education into the total curriculum. The materials contained in the guide are supplementary, and designed to aid the science teacher in providing the kinds of experiences needed by students to gain an understanding of the environmental life processes. The guide contains a series of episodes (minilessons) that are built around 12 major environmental concepts that form a framework for each grade or subject area, as well as for the entire K-12 program. Although the same concepts are used throughout the K-12 program, emphasis is placed on different aspects of each concept at different grade levels or subject areas. This guide focuses on aspects such as succession, ecosystems, and the food chain. Most of the 12 concepts are covered in one of the episodes contained in the guide. Further, each episode offers subject area integration, subject area activities, interdisciplinary activities, cognitive and affective behavioral objectives, and suggested references and resource materials useful to teachers and students. (Author/TK)

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ENVIRONMENTAL EDUCATION GUIDE

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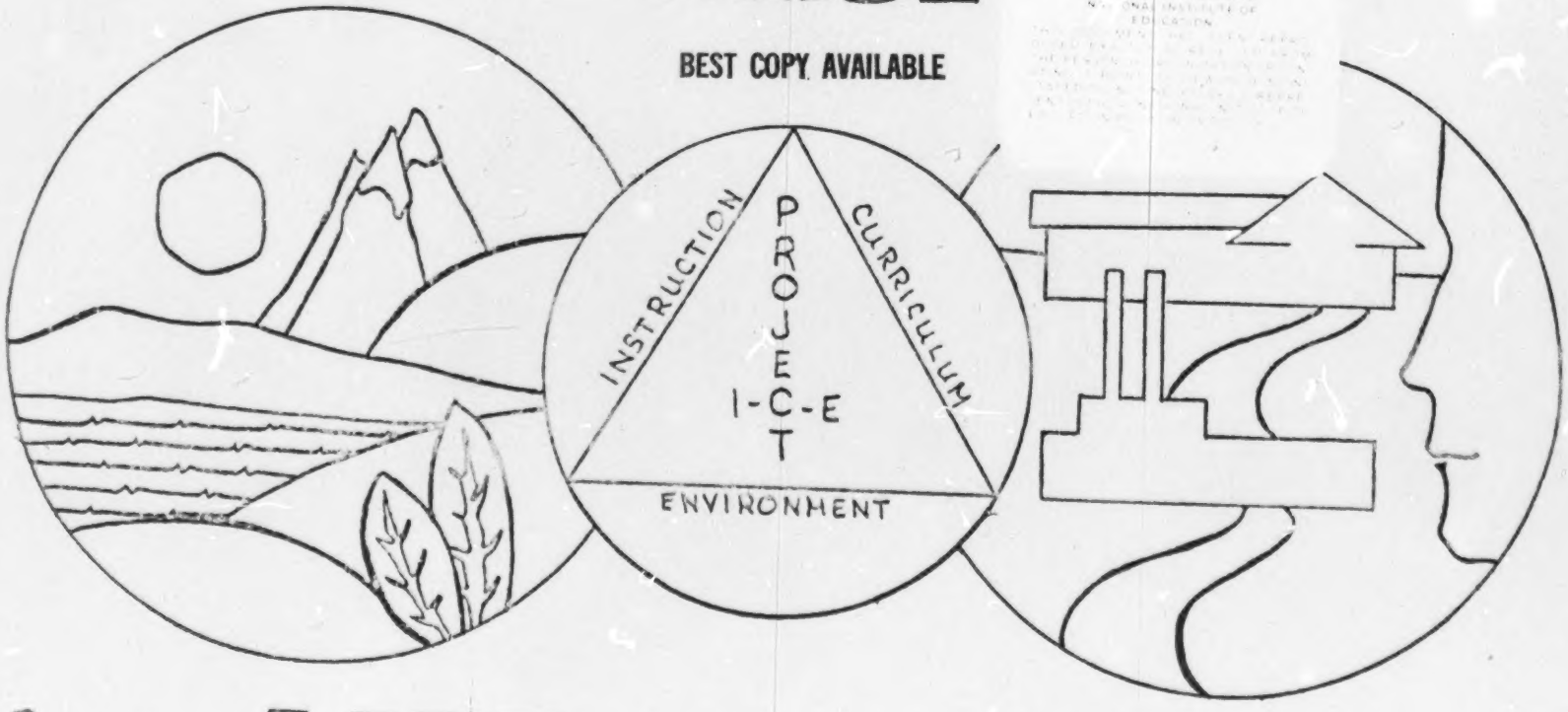

LIFE SCIENCE

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FORWARD TO PROJECT I-C-E ENVIRONMENTAL EDUCATION GUIDES

In 1969, the First Environmental Quality Education Act was proposed in the United States Congress. At the time of the introduction of that legislation, I stated:

"There is a dire need to improve the understanding by Americans of the ominous deterioration of the Nation's environment and the increasing threat of irreversible ecological catastrophe. We must all become stewards for the preservation of life on our resource-deficient planet."

In the three years since the Environmental Education Act was passed by the Congress, much has happened in the United States to reinforce the great need for effective environmental education for the Nation's young people. The intensive concern over adequate energy resources, the continuing degradation of our air and water, and the discussion over the economic costs of the war against pollution have all brought the question of the environmental quality of this nation to a concern not merely of aesthetics but of the survival of the human race.

The intense interest by the public in the quality of our lives as affected by the environment clearly indicates that we cannot just use incentives and prescriptions to industry and other sources of pollution. That is necessary, but not sufficient." The race between education and catastrophe can be won by education if we marshall our resources in a systematic manner and squarely confront the long-term approach to saving our environment through the process of education.

As the incessant conqueror of nature, we must reexamine our place and role. Our world is no longer an endless frontier. We constantly are feeling the backlash from many of our ill-conceived efforts to achieve progress.

Rachel Carson's theme of "reverence for life" is becoming less mystical and of more substance as our eyes are opened to much of the havoc we have wrought under the guise of progress. A strong commitment to an all-embracing program of environmental education will help us to find that new working definition of progress that is a pre-requisite to the continued presence of life on this planet.

- Senator Gaylord Nelson

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PREFACE

If students are to become aware of the living environment around them they must become involved with it. Children of this age level seem to learn best by getting involved with activities that allow them to make observations, collect data, interpret results and draw conclusions.

The materials contained in this packet are designed to aid the science teacher in providing the kinds of experiences needed by students to gain an understanding of the life processes.

The concepts which have been selected deal with the basic interactions of the life processes and their interrelationships and implications on the environment.

An example of the types of materials can be seen in the development of Concept #2. A unit on succession does this very well by involving the students in constructing several aquatic environments. The students gain skill in observing their ecosystems, accumulating data and interpreting their findings. A great amount of enthusiasm can be generated with this activity and be a real asset to the learning process.

The materials included in this packet are not intended to be all inclusive or a total life science program but only as a supplement to your existing programs.

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DIRECTIONS FOR USING THIS GUIDE

This guide contains a series of episodes (mini-lesson plans), each containing a number of suggested in and out of class learning activities. The episodes are built around 12 major environmental concepts that form a framework for each grade or subject area, as well as for the entire K-12 program. Further, each episode offers subject area integration, multi-disciplinary activities, where applicable, both cognitive and affective behavioral objectives and suggested reference and resource materials useful to the teacher and students.

1. This I-C-E guide is supplementary in design--it is not a complete course of study, nor is its arrangement sequential. You can teach environmentally within the context of your course of study or units by integrating the many ideas and activities suggested.

2. The suggested learning activities are departures from regular text or curriculum programs, while providing for skill development.

3. You decide when any concepts. objectives, activities and resources can conveniently be included in your unit.

4. All episodes can be adapted, modified, or expanded thereby providing great flexibility for any teaching situation.

5. While each grade level or subject area has its own topic or unit emphasis, inter-grade coordination or subject area articulation to avoid duplication and overlap is highly recommended for any school or district seeking effective implementation.

This total K-12 environmental education series is the product of 235 classroom teachers from Northeastern Wisconsin. They created, used, revised and edited these guides over a period of four years. To this first step in the 1,000 mile journey of human survival, we invite you to take the second step--by using this guide and by adding your own inspirations along the way.

PROJECT I-C-E TWELVE MAJOR ENVIRONMENTAL CONCEPTS

1. The sun is the basic source of energy on earth. Transformation of sun energy to other energy forms (often begun by plant photosynthesis) provides food, fuel and power for life systems and machines.

2. All living organisms interact among themselves and their environment, forming an intricate unit called an ecosystem.

3. Environmental factors are limiting on the numbers of organisms living within their influence. Thus, each ecosystem has a carrying capacity.

4. An adequate supply of clean water is essential to life.

5. An adequate supply of clean air is essential for life.

6. The distribution of natural resources and the interaction of physical environmental factors greatly affect the quality of life.

7. Factors such as facilitating transportation, economic conditions, population growth and increased leisure time influence changes in land use and population densities.

8. Cultural, economic, social, and political factors determine man's values and attitudes toward his environment.

9. Man has the ability to manage, manipulate and change his environment.

10. Short-term economic gains may produce long-term environmental losses.

11. Individual acts, duplicated or compounded, produce significant environmental alterations over time.

12. Each person must exercise stewardship of the earth for the benefit of mankind.

A "Concept Rationale" booklet and a slide/tape program "Man Needs His Environment" are available from the I-C-E RMC to more fully explain these concepts.

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E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental:

Integrated with:

CONCEPT NO. 1 - Energy

SUBJECT Life Science

ORIENTATION Energy

TOPIC/UNIT Research

BEHAVIORAL OBJECTIVES

Cognitive:

Explain the importance of the food chain in the balance of nature.

Place himself as a link in the chain of life and place the sun as the main energy source, given an incomplete food chain.

Affective:

Support the "sun's energy cycle", using basic research skills through the use of media.

Argue that one must be careful not to destroy a link in the food chain when attempting to eliminate a specific animal or plant.

Skills Used:

1. Location skills:
   a. Use of card catalogue.
   b. Use of the reader's guide, films, film loops, filmstrips

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Class
   1. Discuss the relationship of algae to the sun and its role in the food chain.
   2. Construct a "web of life" with string which will show the interrelationships between plants, animals and man and their dependence on the sun.
      a. Lists should be made of producers and consumers then transferred to a large sheet of paper or cardboard. String can then be used to connect consumers to their food sources and producers to the sun.

Outside or Community:

A. Library
   1. Locate books on ecology showing food chains.
   2. Find magazine articles dealing with the conversion of solar energy.

B. Community
   1. Field trips to discover food chains.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Life Magazine, Ecology Conservation, pamphlet, Cornell University Press ICE field activity guide: Tips For A Good Field Experience **Audio-Visual:** Filmstrips: Urban Ecology: Six Microsystems, Eye Gate House, ICE RMC, FS St 3 Communities of Living Things, McGraw Hill, ICE RMC, FS St 6 Ecology and Man Series, Set 1, McGraw Hill, ICE RMC, FS St 9 Kit: The Total Environment, Steck-Vaughn Co., ICE RMC, KT #41 **Community:** County Soil Conservation Office Agriculture Extension agent School librarian and language arts teacher	

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Environmental: Integrated with:

CONCEPT NO. 1 - Energy SUBJECT Life Science

ORIENTATION Energy Transfer TOPIC/UNIT Respiration

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

BEHAVIORAL OBJECTIVES

Cognitive:

Construct a funnel-type respiration device using elodea subjecting it to various light conditions to show energy transfer of sunlight.

Determine the relationship that exists between the amount of energy received from the sun and the respiration rate of plants.

Affective:

Defend that there is a balance of nature ard transfer of energy between living organisms.

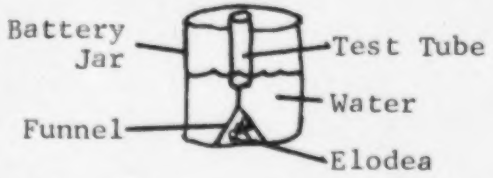
Skills Used:

1. Develop proficiency in performing experiments and investigations.
2. Evaluate collected data.
3. Write reports using graphs of data including an hypothesis drawn from observations.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Investigate the effect of sun energy on respiration of plants through the use of a funnel-type oxygen collector.
   1. Growth of water plants and the collection of oxygen in a test tube.



   a. Place a sprig of elodea plant at the bottom of a battery jar 3/4 full of water and cover with a glass funnel. Place the open end of a water-filled test tube over the stem of the funnel.
   b. If any air remains in the tube above the water this

(Continued)

Outside or Community:

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SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: SCIS Elementary Science Source-book, Rand McNally and Co., ICE RMC, 110 Ja Environmental Units, in cooperation with Minnesota Environmental Sciences Foundation, National Wildlife Federation, "Plants in the Classroom", ICE RMC, 120 Nw(3) **Audio-Visual:** **Community:**	CLASSROOM (Continued) level should be marked for future reference. c. Three jars as described in #1 should be constructed. 1) Mark one Jar A and place in direct sunlight. 2) Jar B should be placed in the light but not in direct sunlight. 3) Jar C should be placed in a darkened area. d. Allow plants to remain in the funnel for at least 24 hours. Students will then, without removing test tubes, measure the amount of change in the air space above the water. e. Students should keep complete records of their observations and data collected. A hypothesis should be included to support their observations along with a record of their data in the form of a written report. Note: The possibility of presence of oxygen can be shown by removing the test tube and inserting a glowing splinter of wood.

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Environmental:

Integrated with:

CONCEPT NO. 1 - Energy

SUBJECT Life Science

ORIENTATION Energy

TOPIC/UNIT Food Chain

E. S. E. A. Title III – PROJECT I-C-E 59-70-0135-4

BEHAVIORAL OBJECTIVES

Cognitive:

Illustrate, through a mobile construction, the concept of the sun as the basic source of all energy and the process of photosynthesis as a converter of energy into a utilizable source by other living organisms.

Affective:

Offer suggestions concerning solutions to food chain crises when presented with such situations.

Investigate breakdowns in this food or energy chain in the community area as an outside project to determine the cause.

Skills Used:

1. Organizing materials.
2. Analyzing data.
3. Synthesizing resource material for mobile construction.
4. Evaluating.
5. Basic language skills in presentation to class.
6. Art skills.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. The student will view the movie, Food Cycles and Food Chains.
   I. The teacher will prepare a chart or other visual materials and short presentation on the food chain and green plants and sunlight.
B. Resource material on energy sources and food chains. (Hangers, string, paper etc. will be supplied.
C. Student will develop a food energy chain and indicate its flow by art work in the form of a mobile.
D. The finished mobile will be displayed and the student will explain his project.
E. A movie entitled Green Plants and Sunlight will be shown with the specific purpose of the student evaluating his project as to completeness on the initial energy levels.

Outside or Community:

A. Students may select any energy system in the local community and through art work, illustrate the total flow of energy from initial energy generation to the final product or use.
B. Students will select an insecticide and describe the possible total effect on their energy system.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: *Foundations of Life Science*, Trump, Volker, Holt, 1971 *Investigations into Ecology*, ICE RMC, 110 Ec *Communities--Science Curriculum Improvement Study*, 1969, ICE RMC, 110 Kn **Audio-Visual:** Posters of food chains on bulletin board Films: *Food Cycle and Food Chains*, BAVI *Green Plants and Sunlight*, BAVI **Community:** Field trip to local wooded area, vacant lot or cemetary	

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Environmental:

Integrated with:

CONCEPT NO. 2 - Ecosystem

SUBJECT Life Science

ORIENTATION Ecosystem

TOPIC/UNIT Succession

BEHAVIORAL OBJECTIVES

Cognitive:

Explain the reason for natural succession in an ecosystem.

Analyze a change in an ecosystem to determine whether it is succession or an interruption of succession.

Affective:

Investigate the process of succession which is affected by man's uncontrolled technology.

Attempt to identify characteristics of changes in an ecosystem that are the result of natural succession.

Skills Used:

1. Finding comparative data.
2. Discussion of succession & its changes on a community.
3. Skills in microscope use.

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. The students, in small groups, should be supplied with three one-gallon jars per group.
   1. First jar--Place an assortment of twigs, dead leaves and pond stones into 2/3 gallon of sterilized pond, river or lake water. (Boil water 2 minutes.)
   2. Second jar--1" fine gravel and 2/3 gallon unsterilized lake water with several organisms from the pond, river or lake.
   3. Third jar--2/3 gallon unsterilized pond, river, or lake water. Cover jars and place in indirect sunlight or under lamp.

B. Supply the students with a key for common pond water organisms.

C. The students will observe growth changes in each jar daily for an 8-day period using microscopes or hand lens,

(Continued)

Outside or Community:

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES

Publications:

Modern Life Science, Hole, Fitzpatrick
Interactions of Man and the Biosphere, Rand-McNally
Algae in Water Supplies, U.S. Dept. of Agriculture

Audio-Visual:

Films:
Life in a Drop of Water, BAVI
Life in a Pond, BAVI

Community:

CLASSROOM (Continued)

making comparisons, drawing pictures and presenting results in written paragraph form.

1. The student's report will be based on observation of accumulated data from the creation of a biological community illustrating the interaction of living things.
2. Acceptable performance will include setting up a controlled experiment with sterilized & unsterilized pond water, classifying by common name organisms which appear after an 8-day growth period and observing growth changes in each of the three jars based on environmental conditions. These changes will be presented in a short paragraph and evaluated on correct interpretation of data.

Note: The 8-day growth period should allow enough time for good growth and development of organisms within the aquatic environments.

Environmental:

Integrated with:

CONCEPT NO. 3 - Carrying Capacity

SUBJECT Life Science

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ORIENTATION Carrying Capacity

TOPIC/UNIT Plant Communities

BEHAVIORAL OBJECTIVES

Cognitive:

Determine the population of small plants in a given area using the sampling technique.

Determine relationships between the number and kinds of plants present in the area and the conditions of the area. Acceptable performance will include writing an organized summary of his study indicating

(Continued)

Affective:

Support the statement that environmental resources determine the carrying capacity of an area.

Propose several ways in which the carrying capacity of a given area might be increased.

Skills Used:

1. Observing.
2. Comparing.
3. Recording and interpreting data.

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Students, working in small groups, should construct a sampling device to be used to randomly sample and survey an area for plant cover.
   1. Bend coat hanger into a hoop.

B. Throw the coat hanger into area to be sampled. Examine and count specimens within hoop.
   1. Keys should be supplied to students for identification of plant material.

C. Comparisons should then be made between the various testing sites and their representative samples.

Outside or Community:

A. Field trip for sampling plant populations.
   1. Test sites.
      a. Land around the school.
      b. Vacant lots.
      c. Park.
      d. Cemetary.
      e. Roadside.
   2. Samples should be randomly taken and from as many different areas as possible.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Interaction of Man and The Biosphere, Rand-McNally BSCS: Green Version, Rand-McNally **Audio-Visual:** Films: Distribution of Plants and Animals, BAVI Desert, BAVI High Arctic Biome, BAVI **Community:**	COGNITIVE (Continued) why the population existed there in such types and numbers.

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Environmental:

Integrated with:

CONCEPT NO. 4 - Water

SUBJECT Life Science

ORIENTATION Water Analysis

TOPIC/UNIT Water Quality

BEHAVIORAL OBJECTIVES

Cognitive:

Determine the quality of water in a given body of water (stream, lake, etc.) by properly sampling and analyzing the samples.

Evaluate data obtained from water sampling investigations in his area to determine if it was properly obtained and is representative of the area being studied.

Affective:

Investigate the quality of the water resource in his area.

Suggest ways his water quality can be preserved or maintained.

Skills Used:

1. Water sampling techniques.
2. Interpreting experimental results.
3. Acquiring new values pertaining to dangers of water pollution.
4. Comparing results.

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Analyzing samples.
   1. Students should prepare microscope slides or observe water samples under a binocular microscope or hand lens for aquatic or benthic organisms.
   2. Tests which were started in the field should be completed in the classroom.

B. Report of findings.
   1. Students should prepare a written report which will include all data collected and an evaluation made of their findings. Their evaluation should be based on deviations from accepted norms for the particular water source under study.
   2. Reports should be presented to the class followed by a discussion of local water problems and

(Continued)

Outside or Community:

A. Water sampling.
   1. Students in small groups will collect two water samples in clean, sterilized bottles.
      a. One sample should be collected in a dissolved oxygen collection bottle.
      b. The other sample should be collected in a bottle which can be tightly closed.
      c. Collecting devices can include commercial models or homemade units made from a cut-open plastic one gallon jug.
      d. Water should be delivered to the D.O. bottle through a siphon tube with a minimum of agitation.
      e. Bottles should be labelled with the following:

(Continued)

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES

Publications:

The Clean Brook, Margaret Bartlett
Water: Riches or Ruin, Helen Bauer
Busy Water, Irma Simonton Black
Lamotte Water Test booklet
DNR Booklet: Public Use Laws of Water in Wisconsin.
Minnesota State Dept. of Health, Analysis Reports on Mississippi River
Standard Methods for Examination of Water and Wastewater, Am. Public Health Association

Audio-Visual:

Films:
The Gifts, ICE RMC, Film #280
The Stream, ICE RMC, Film #320

Community:

CLASSROOM (Continued)

methods for preserving or upgrading water sources.

OUTSIDE ACTIVITIES (Continued)

1) Place of sampling.
2) Date of sampling.
3) Time of sampling.
4) Temperature of water.
5) Weather conditions.

2. Method of testing.
   a. Water sampling kits may be used if available, such as:
      1) Hach kits.
      2) LaMott kits.
      3) Ecology kits.
      4) Millipore kits.
      5) Others.
   b. Standard methods may also be used for testing. (see reference)
3. Suggested parameters for study of water.
   a. Dissolved Oxygen.
   b. Phosphate.
   c. Nitrate.
   d. Nitrite.
   e. Carbon dioxide.
   f. pH.
   g. Turbility.
   h. Benthic organisms.
   i. Stream flow.
   j. Bacteria.
4. Location of sampling.
   a. Different teams should take samples from various locations and at various depths for data comparisons.

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental:

Integrated with:

CONCEPT NO. 4 - Water

SUBJECT Life Science

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ORIENTATION Salt Concentrations

TOPIC/UNIT Water Quality

BEHAVIORAL OBJECTIVES

Cognitive:

Describe the relationship that exists between the type and degree of pollution of water and the effect on spirogira.

Compare the effect of pollution on spirogira and the effect on higher animals.

Affective:

Volunteer comments on ways water resources should be handled and proposals made as to action that could be taken for such resource management.

Skills Used:

1. Practice in preparing slides.
2. Using microscope.
3. Analyze experimental data.
4. Synthesize results.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Marine communities.
   1. Four 1-pint bottles of different salt solutions.
      a. 1 tsp. in 1st pint.
      b. 4 tsp. in 2nd pint.
      c. 8 tsp. in 3rd pint.
      d. 16 tsp. in 4th pint.
      e. 1 bottle fresh water.
   2. With medicine dropper, place drop of fresh water on microscope slide.
   3. With forceps, place a strand of spirogira in the water on the slide. Place a cover slip over the drop and study under the microscope. (Note green, spiral chloroplast in each cell.)
   4. Now place a drop of weakest salt solution on another

(Continued)

Outside or Community:

A. Outside activity.
   1. Students will collect samples of water from a minimum of six differing areas. The student should attempt to acquire water from severely polluted areas (water high in toxic material) in the community or adjoining area.
   2. The collected water will then be subjected to similar strains of spirogira and the effect on each one recorded.
   3. The water collected should include some which is presumably high in inorganic toxic material.
   4. Have students test the effect of a specific inorganic substance such as $CUSO_4$ (copper sulfate) spirogira organism. Discuss the long range effects of such materials.

SUGGESTED RESOURCES

Publications:

Sea Shores, H. Zim and L. Ingle, New York, Simon & Schuster, 1955

Environments, teacher's guide, SCIS, Rand McNally, ICE RMC, 110 Ka

Audio–Visual:

Film:
Life in a Drop of Water, BAVI

Equipment:

microscope	micro-slide
cover slips	4 pint jars
teaspoon	eye dropper
scalpel	forceps
salt	spirogira

Community:

CONTINUED OR ADDED LEARNING ACTIVITIES

CLASSROOM (Continued)

microscope slide, add spirogira and cover slip.

5. Observe changes in cell content and appearance.
6. Repeat procedure with other salt solutions.
7. Make a note of the time it takes before you see any changes in the appearance of spirogira for each of the solutions.
8. Make a drawing with a written description of changes observed for each solution.
9. Repeat same procedure using:
   a. Protozoans.
   b. Algae.
   c. Elodea.

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E. S. E. A. Title III – PROJECT I-C-E 59-70-0135-4

Environmental:

Integrated with:

CONCEPT NO. 4 - Water

SUBJECT Life Science

ORIENTATION Habitat Determination

TOPIC/UNIT Water Quality

BEHAVIORAL OBJECTIVES

Cognitive:

Determine how indicator organisms that live in fresh water can show importance of clean water to maintain the balanced water community.

Affective:

Propose that future generations will take care of our water resources with more concern than present and past generations.

Attempt to design a plan for preserving a local water resource.

Skills Used:

1. Accumulating scientific data.
2. Knowledge of relationships between organisms.
3. Understanding of how or why all living things are dependent on unpolluted water. (Continued)

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Class discussion. Compare indicator organisms and their problems to show effects of water pollution on living creatures.

Note: Outside resource and community activities should precede in-class activity.

Outside or Community:

A. Divide class into groups, assign each group a fresh water indicator organism to study that is or was native to the area. Ex.-trout.
   1. What quality of H_2O must trout have to survive?
      a. Temperature.
      b. Purity levels.
      c. Food organisms in streams which trout need.
      d. Oxygen levels needed.
      e. Protective cover.
      f. Upper watershed conditions.
      g. Erosional rates.
   2. How does your area stack up to above conditions?
   3. Survey actual trout population.
   4. List factors in your area which have led to lowering trout population or may in the future.
   5. Check with DNR on present condition of

(Continued)

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: The Clean Brook, Margaret Bartlett Water, Our Most Valuable Natural Resource, Ivan Green Rivers, Della Coetz Tips for a Good Field Experience, ICE field activity guide **Audio-Visual:** **Community:** DNR Wisconsin Conservation Bulletins Local DNR fish management official	SKILLS (Continued) 4. Understanding of the DNR and its role in protecting our non-renewable resources. OUTSIDE ACTIVITIES (Continued) trout streams in Wisconsin. What is being done by state to rehabilitate streams. 6. List possible cures which might be undertaken to improve deteriorating conditions. 7. Show the relationship between all life in the streams and water quality.

Environmental:

Integrated with:

CONCEPT NO. 4 - Water

SUBJECT Life Science

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ORIENTATION Effects of Selected Pollutants

TOPIC/UNIT Water Quality

BEHAVIORAL OBJECTIVES

Cognitive:

Demonstrate, using a microscope, that unpolluted water is essential for sustaining life.

Describe the effects of foreign materials on an unbalanced environment.

Affective:

Demonstrate a change in attitude toward water quality by making a list of materials, which should not be used or put into water supplies.

Propose that such contamination must cease and that programs should be developed to end such pollution.

Skills Used:

1. Planning a pond.
2. Accumulating appropriate pond organisms.
3. Analyzing and synthesizing data.
4. Organize materials and scheme to test organisms with pollutants.

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Fresh water communities.
   1. Set up two aquariums containing several kinds of water plants, fish and snails.
   2. Have plenty of water plants already established in this aquarium before you add the animals, use water plants which have been collected or elodea.
   3. Students will make a useful study of the micropond communities using the following guide:
      a. Type of algae found.
      b. Increase or decrease in population.
   4. Students develop a hypothesis on the nature of the rise and fall of the population of the micropond.

(Continued)

Outside or Community:

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: High School Biology, BSCS Green Version, Rand-McNally Investigations into Ecology, ICE RMC, 110 Ec Algae in Water Supplies, U.S. Department of Agriculture **Audio-Visual:** **Community:**	CLASSROOM (Continued) B. Select a commonly used product which is flushed down home drains. An example would be: detergent, auto polish, soap, water soluble paint, fertilizer, insect poison, disinfectants, toothpaste, hair spray. C. Introduce the selected substance into one of the micro-ponds. Make observations on both communities and record any changes noted following the format of "3" above. 1. The amount of substance introduced should be carefully controlled to be a meaningful investigation. Note to Teacher: Students should write a brief outline of their experiment before performing it. Be sure they know what to test and what observations to make beforehand.

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental: Integrated with:

CONCEPT NO. 5 - Air SUBJECT Life Science

ORIENTATION Respiration in Plants TOPIC/UNIT Air Pollution

BEHAVIORAL OBJECTIVES

Cognitive:

Describe respiration including the roles of CO_2 and O_2.

Analyze the statement, "While polluted air may make it difficult for animals to have respiration, it has no effect on plants."

Affective:

Suggest that living organisms need air to survive and assist in energy release within the organism itself.

Attempt to observe the use of oxygen by the plant.

Skills Used:

1. Comparing and recording data.
2. Discussion of environmental effects of air pollution.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. The use CO_2 by aquatic plants (elodea).
   1. Pour bromthymol blue solution into a beaker and add enough aquarium water to the beaker to fill six test tubes.
   2. With a straw, blow your breath into the bromthymol blue solution in beaker.
   3. Bromthymol blue solution turns yellow upon introduction of CO_2.
   4. Place a sprig of elodea into each of four test tubes.
   5. Fill the six test tubes with yellow converted bromthymol solution and stopper them securely. Two of the test tubes will be used as controls.
   6. All test tubes should be placed in medium sunlight.

(Continued)

Outside or Community:

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications:	CLASSROOM (Continued) B. Student investigation of CO_2 use by plants should contain interpretation of the following: 1. Color of yellow bromthymol blue. 2. Determination of optimum light color for photosynthesis to occur. (Wrap tubes with color cellophane. 3. The student will then discuss where the oxygen goes which is produced by the plant as the CO_2 is used up.
Audio–Visual: Films: Photosynthesis, BAVI Green Plants and Sunlight, BAVI Equipment: 6 test tubes and stoppers elodea 25 ml of 0.1% bromthymol blue	
Community:	

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental:

CONCEPT NO. 5 - Air

ORIENTATION Effects of Air Quality on Disease

Integrated with:

SUBJECT Life Science

TOPIC/UNIT Air Pollution

BEHAVIORAL OBJECTIVES

Cognitive:

Explain effects of air pollution on various diseases by collecting data, articles, statistics and writing to states and cities to find any facts that pertain to air pollution and its effect as a disease-causing agent.

Affective:

Carry on a detailed research on the effects of pollution of our air and how it affects the nation's health.

Volunteer ideas indicating that polluted air is a hazard to all living things and to all future generations.

Skills Used:

1. Journalism skills.
2. Data collecting.
3. Understanding of the real danger of air pollution.
4. Understanding the principle of diffusion and the

(Continued)

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Group research paper.
   1. Class will be divided into 4-5 groups with a group leader or chairman.
   2. Each group will conduct a survey on the effects of air pollution and the contraction rate of a particular disease.
   3. Possible study areas:
      a. Lung cancer.
      b. Heart disease.
      c. Emphysema.
      d. Tuberculosis.
      e. Pneumonia.
      f. Bronchitis and other respiratory ailments.
   4. Group leaders will assign study areas:
      a. Regional areas (state health departments).
      b. Large cities (health departments).
      c. Library research.
      d. Magazine and newspaper articles.

(Continued)

Outside or Community:

SUGGESTED RESOURCES

Publications:

This Vital Air, Thomas Aylesworth
The World You Inherit: A Story of Pollution, John Gabriel Navarra
Let's Go to Stop Air Pollution, Michael Chester
Dangerous Air, Lucy Kavaler
30 Basic Speech Experiences, Clark Publishing Company

Audio–Visual:

Community:

State health department.
DNR
Local pollution and health officials
Local politicians

CONTINUED OR ADDED LEARNING ACTIVITIES

SKILLS (Continued)

realization that air pollution (to a degree) reaches everywhere.

5. Ability to evaluate and draw conclusions.

CLASSROOM (Continued)

e. Interview:
   1) Local health officers.
   2) Physicians, etc.
f. Health bulletins and manuals.
g. Wilderness area or states.

5. Each group will accumulate material and prepare report for class presentation.
   a. All presented material will be verified by bibliography of sources.
   b. Each group will attempt to show unbiased proof that air pollution has or has not affected the contraction rate of a particular disease.
6. Class discussion (possible areas):
   a. Question and answer period.
   b. Present day air pollution problems.
   c. Affect: Cities, rural and wilderness areas.
   d. Future of air pollution problems:
      1) Legislation.
      2) Industrial.
      3) Transportation, etc.
   e. Summary and conclusions (values--before and now).

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental:

Integrated with:

CONCEPT NO. 6 - Resources

SUBJECT Life Science

ORIENTATION Populations

TOPIC/UNIT Ecosystems

BEHAVIORAL OBJECTIVES

Cognitive:

List, in written form, the geographic conditions responsible for larger populations of these species thru observation of ant hill populations and guppy populations.

Analyze those conditions responsible for smaller populations for comparison of the two lists of geographic conditions.

Affective:

Support the proposal that natural resources are not distributed equally and thus affect the quality of life in any given area.

Skills Used:

1. Observation.
2. Systematic counting.
3. Comparing data.
4. Writing a scientific report.
5. Analyzing data.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Observe a guppy population in an aquarium. Determine the size of the population and population density over a period of time seeing if the population fluctuates.
   1. Determine size of population by counting organisms.
   2. Determine density of population by computing number of organisms per unit area.
   3. Describe physical environment of organism noting size, soil type and amount, amount of water, number of plants and large stones and other features.
   4. Continue observations over two week period making daily records.

Outside or Community:

A. Find an ant hill or nest of carpenter ants. Try to estimate the number of organisms. Try to determine the population density. (Use ants per hill or nest.) Determine the expected fluctuations in the ant population.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: *Modern Life Science*, Fitzpatrick, Hole *Interaction of Man and the Biosphere*, Rand McNally and Co. **Audio–Visual:** Film: *Distribution of Plants and Animals*, BAVI **Community:** Forest manager Forest ranger Agriculturist University ecologist	

E. S. E. A. Title III – PROJECT I-C-E 59-70-0135-4

Environmental: Integrated with:

CONCEPT NO. 7 - Land Use SUBJECT Life Science

ORIENTATION Impacts of Environmental Change TOPIC/UNIT Land Use

BEHAVIORAL OBJECTIVES	STUDENT-CENTERED LEARNING ACTIVITIES	
	In-Class:	Outside or Community:
Cognitive: List changes in land use for human considerations rather than for the balance of the environment. Report on one case from his list that has a definite impact on local area.	A. Research project. 1. Part one. a. Compile an extensive list of changes man has made in the local environment which have resulted from factors other than preservation of the environment. 2. Part two. a. Extensive research report on one land use change on your list. b. Encourage: 1) Objectivity. 2) Opinions of local people. 3) Overall impact of change. 4) Conclusions. 3. Part three. a. All students should present their research reports to class for overall discussion and (Continued)	A. A valuable field experience can be gained from the use of A Land Ethic, an ICE field activity guide. Available from the ICE RMC.
Affective: Advocate or reject the way man has viewed the overall environment as compared to the importance of man's immediate and material gains.		
Skills Used: 1. Scientific technique. 2. Problem solving. 3. Decision making. 4. Personal values.		

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Tips for a Good Field Experience, ICE field activity guide. A Land Ethic, ICE field activity guide. **Audio-Visual:** Films: Population Problem, U.S.A, Seeds of Change, BAVI Standing Room Only, BAVI **Community:** Local papers Library Government officials County courthouse Local agriculture agent Corporation environmental control agent University biologists or guest lecturers	CLASSROOM (Continued) evaluation. This will present the class with values that will classify as group or individual values. Each environmental change should be examined as to reason and/or capital gain. Location and date of change.

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental:

Integrated with:

CONCEPT NO. 8 - Values and Attitudes

SUBJECT Life Science

ORIENTATION Resource Use

TOPIC/UNIT Environmental Utilization

BEHAVIORAL OBJECTIVES

Cognitive:

Complete an activity designed to show how man's values and attitudes have been shaped by factors other than the preservation of the natural environment. Acceptable performance will include the material and presenting it verbally to the class, illustrating changes in man's values and attitudes as in-

(Continued)

Affective:

Defend the fact that the status of man's values toward his environment must be re-evaluated and emphasis placed on mutual harmony with nature.

Skills Used:

1. Using graphs and their interpretation.
2. Understanding the danger to all life of overpopulation.
3. Development of self-appraisal of one's own values.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Class will be divided into four groups to discuss the above concept through the following activities:
   1. Activity #1 - Utilizing water-use figures, students can graph consumption rates for their local community. Factors that contribute to increased water consumption can be developed by class.
   2. Activity #2 - Students can attempt to project the effect on the world supply of natural resources if an underdeveloped country were to become highly westernized. For example, if China were to have the same number of automobiles per capita as the U.S.

(Continued)

Outside or Community:

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES

Publications:

The Effects of Overpopulation, Richard Kimball, ICE RMC, 190 Ki
Population Bomb, Paul Ehrlich, New York, Ballantine Books
World Almanac

Audio-Visual:

Films:
Bulldozed America, BAVI
Man's Impact on His Environment, BAVI
Cry of the Marsh, ICE RMC, Film #390
The Tree House, Holt, Rinehart and Winston, New York

Community:

City water department
Local city officials
Ford Motors, Detroit, MI

COGNITIVE (Continued)
fluenced by the negative use of our natural environment.

CLASSROOM (Continued)

3. Activity #3 - Assume that a small community were to be a location of a large factory employing several hundred people. Have students predict the effect of the sudden rise in population on the natural resources of the area.
4. Activity #4 - A class or group might list the number and amounts of natural resources that are used in the manufacture of an automobile. A similar list of natural resources that were used in the manufacture of a 1930 auto could be developed and a comparison made.

B. Each group will also list problems of their study area and what possible solutions may avert these problems in the future.
C. Groups will present their study area to the class for discussion and possible values involved.

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental:

Integrated with:

CONCEPT NO. 10 - Economic Planning

SUBJECT Life Science

ORIENTATION Habitat Destruction

TOPIC/UNIT Ecosystems

BEHAVIORAL OBJECTIVES

Cognitive:

Research and orally report on four historic blunders of man which have backfired on him in his efforts to achieve short-term economic gains.

Evaluate a change in the ecosystem to determine if the change is positive or negative in regard to the habitat.

Affective:

Support that man has hastened the destruction of his environment with his shortsightedness and greed.

Advocate values which will prevent this from happening in the future.

Skills Used:

1. Knowledge of statistics and its evaluation.
2. Development of environmental values.
3. Need for better planning & experimentation before implementation.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Class project
   1. Divide class into small groups.
   2. Each group conducts a survey and prepares an oral report on local or national instances which will attempt to prove Concept #10.
      Possible examples:
      a. Introduction of carp from Europe.
      b. Introduction of Dutch elm disease to U.S.
      c. Introduction of citrus fruit trees which brought in the scaley insect.
      d. Introduction of Japanese beetle.
      e. Introduction of potato blight.
      f. Hoof and mouth disease from Mexico.

Outside or Community:

A. Guest speaker:
   1. DNR representative to speak on introduction and effects of foreign species to the ecosystem and laws which are designed to prevent such introductions.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Encyclopedia Britannica **Audio–Visual:** **Community:** Audubon Society U.S. Department of Agriculture County agent Department of Natural Resources	

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental:

Integrated with:

CONCEPT NO. 11 - Individual Acts

SUBJECT Life Science

ORIENTATION Individual Acts Which Affect Quality

TOPIC/UNIT Environmental Quality

BEHAVIORAL OBJECTIVES

Cognitive:

Construct a slide, movie or photograph sequence showing individual acts which have resulted or could result in a degraded environment. The student will present his slides to the class along with an oral report of his findings.

Affective:

Seek out what he considers to be an individual act resulting in environmental alteration.

Propose how these individual acts should be controlled to save the environment.

Skills Used:

1. Photography.
2. Organization of a slide, movie or photograph series.
3. Observing.
4. Speaking skills.
5. Creativity in photography presentation.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. The students will select groups for making photographic sequence.

Outside or Community:

A. The student will go into the community and photograph acts which lead to the degradation of the environment and by combined effort construct a photographic presentation showing man destroying his environment both short term and long term. The student will narrate his own presentation.

B. Students can construct a community survey asking questions concerning actions which have taken place in the community which have resulted in local degradation of the environment.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Photography magazine in library	
Audio–Visual: Film: The Gifts, ICE RMC, Film #280 Filmstrips on ecology and environment available in most schools to use as a guide to a slide series.	
Community: School AV man can come in and illustrate how a photography series is constructed. George Howlett, Project ICE, on environmental photography.	